

KDHE Staffer Contributes to African Public Health Progress

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Sample and Data Management

(Editor's Note: Bob Bostrom, DHEL Sample and Data Management manager, recently returned from two weeks in Africa as part of a multi-national team assisting with evaluations of laboratory environments, and the installation of new equipment to improve the public health infrastructure. This is Bob's first-person report on his trip.)

During the first week of March, I had the unique opportunity to visit several hospital laboratories in Tanzania, located on the eastern African shore on the Indian Ocean between Kenya and Mozambique, as a part of a team evaluating laboratories in that country for the installation of modern electronic laboratory information management systems.

The team was derived from the membership of the Association of Public Health Laboratories (APHL), of which the KDHE Laboratory is a member. The impetus for this project comes from the fact that while laboratories in developing countries are currently making significant progress in addressing the AIDS epidemic as a result of the influx of funds from world health organizations, many have great difficulties in handling the large amount of data produced from the laboratory tests. Consequently, because the country is unable to process this data in a timely manner, getting the proper aid to locations within the country that needs it most has been difficult.

The president, through Congress, appropriated many millions of dollars for the purpose of combating the AIDS epidemic in underdeveloped countries, primarily in Africa, but also in Southeast Asia and the Caribbean. The program is known as the President's Emergency Plan for AIDS Relief (PEPFAR). The funds are administered under the Department of State through the Office of the Global AIDS Coordinator (OGAC). The Centers of Disease Control (CDC) was given a portion of these funds to enhance laboratory capacity in these countries and provide training in testing and treatment.

As CDC began enhancing laboratory capabilities, it became apparent that these laboratories now had the capacity to analyze hundreds more specimens than they had analyzed previously, so they began collecting hundreds more specimens. A bottleneck soon arose in that while the laboratories could collect and analyze more specimens, they did not have the capacity to handle and analyze the enormous amount of data these analyses were producing. Consequently, CDC contracted with APHL to develop a plan and a process to put electronic data handling methodologies in place in selected laboratories in PEPFAR countries.

APHL had significant experience in doing this because it had published a document called *Requirements for Public Health Laboratory Information Management Systems* in 2003 and followed it by developing and publishing the *Logical Design for Public Health Laboratory Information Systems* in two phases electronically in 2004 and 2005. These documents were major milestones in LIMS development for public health organizations. The publication of these two documents was accomplished through the collaboration of more than 25

state and local public health laboratories and represented the first effort to get public health laboratories to share their experiences in developing or purchasing laboratory information management systems (LIMS). The KDHE laboratory was a major contributor to those efforts. The project has generated several other collaborative projects that have led to a greater understanding of the need to share information among state, local and federal partners and provided a model by which that sharing can occur.

APHL first gathered the information necessary for the project through site visits to most of the countries. That led to the publication of four documents: 1) *PEPFAR Laboratory Information System (LIS) High Level Requirements*; 2) *Toolkit to Accompany the PEPFAR Laboratory Information System (LIS) High Level Requirements*; 3) *Guidance Document for Implementation of Laboratory Information Systems in Resource Poor Settings*; 4) *Laboratory Information System Software Provider Report*. These documents formed the basis and the guidelines required for LIMS development in the PEPFAR countries. A kickoff meeting for PEPFAR countries was held in South Africa last fall where these documents were distributed and the project was discussed.

Late last year, after distributing the APHL documents to the PEPFAR countries, CDC asked each country if it was willing to participate in laboratory information system (LIS) development in their country's laboratories. Each country, if it responded positively, was required to allocate funds for the support of the actual LIS development. Three countries, Mozambique, Vietnam and Tanzania, responded in early 2006 and agreed to allocate funds.

Consequently, APHL formed teams of laboratory and IS professionals to go into those countries to gather specific information about each country's laboratory system and help them develop the methodology for either building or purchasing an LIS specific to each country's need. This initial team effort is being funded using CDC funds, but it is anticipated that the cost of the actual implementation will be borne by the countries themselves. One of these teams visited Vietnam in late February and another is scheduled to go to Mozambique in June.

I was selected to go to Tanzania largely because of my particular IT and laboratory experience. I had participated in the workgroup that put together APHL's Requirements and Design Documents, I participated in the development of the four PEPFAR documents, had relevant laboratory experience and had substantial experience in developing and managing laboratory information systems. Other members of my team were Alpha Diallo, the Deputy Director of the District of Columbia Public Health Laboratory and Lucy Maryogo-Robinson, a native Tanzanian and an APHL staff member.

The team's assignment was to meet with Tanzanian government and health officials along with the CDC staff already in the country to determine exactly what the country might need in a laboratory information system if one were developed there and develop a preliminary action plan for implementation. The trip was largely a fact-finding mission that will enable other APHL and laboratory teams to develop a laboratory information system to meet the

country's specific need and to ensure the proper management and availability of the data produced.

We flew into Dar es Salaam, the capital of Tanzania, early Sunday, March 5 and got up early Monday to catch a plane to Mwanza, about 600 km (a kilometer equals 0.621 miles) northwest of the capital to visit the Bugando Zonal Hospital and its blood bank. Following that visit, we drove 200 km southeast of Mwanza to visit the Shinyanga Regional Hospital in Shinyanga. We were accompanied on that trip by a representative of the Tanzanian Ministry of Health and two representatives of the CDC stationed in Tanzania. We returned to Dar es Salaam late Monday.



The Shinyanga Regional Hospital

The structure of the Tanzanian health system is rather hierarchical and made up of five reporting layers based on the way information flows. At the bottom are the Health Centers and Dispensaries that do little testing, but are primarily used to distribute drugs or dispense medications. The results of the testing that are done, however, are reported to one of the District Hospitals, which are at the next level, dispersed throughout the 21 health “regions” of the country. These hospitals see the majority of the AIDS patients and their laboratories process a few

manual tests.

For the most part they are very sparsely equipped with little modern laboratory instrumentation, but the laboratory staff seems very proficient. Typically, there are no computers in these laboratories and laboratory results are kept in notebooks. The District Hospitals report their results to the Regional Hospital in their health region. The 21 Regional Hospitals see patients who have more serious problems. Their laboratories have some modern equipment and they perform more complex tests, but, for the most part the tests are done manually. Typically, there are no computers in these laboratories either and lab results are also maintained in notebooks. Results from these laboratories, along with the results from the District Hospitals are reported to the Ministry of Health, usually once each year in the form of a condensed management report detailing such things as number of tests, kind of test, etc.

The four Zonal Hospitals produce management reports distilled from the collection of laboratory results which are sent directly to the Ministry of Health, so those hospitals, along with the National Hospital are effectively at the same reporting level as the Regional Hospitals in the health system hierarchy. It is the responsibility of the Ministry of Health to allocate resources at the Zonal, Regional and District levels.

These Zonal hospitals tend to be in larger cities and are equipped to handle a much larger patient load. The laboratories are typically better equipped with instrumentation and generally better staffed than the Regional Hospitals. Some have instrumentation with computer control that can process a larger number of samples than could be processed manually. There is no information system to manage patient data and results in any of these laboratories, however, and patient results are kept in notebooks, similar to those in the Regional Hospitals. Most of the Zonal hospitals have blood banks associated with the hospitals. The blood bank we visited in Mwanza was well equipped with modern instrumentation and computers, however, none of the computers were networked and the reporting of test results was still done manually.



The laboratory of the Bugando Zonal Hospital in Mwanza.



Data records are handwritten.

The following two days were filled with meetings with laboratory staff from several of the hospitals in and near Dar es Salaam, several physicians and staff from the Ministry of Health. In these meetings, the ministry and hospital staff presented what they believed was the current state of laboratory information systems in the country's hospitals and some ideas and suggestions of things that they would like to incorporate if possible.

The APHL team presented a general overview of laboratory information systems, and the advantages of installing such a system. In addition, the APHL team discussed what they had seen as a part of their "field trips," and made a few recommendations to the group for consideration. In addition, implementation timelines for the proposed laboratory information systems were discussed.

Also during those two days, the team visited the Muhimbili National Hospital laboratory in Dar es Salaam. The hospital is associated with the local university, so the laboratory provides training for students as well as processing specimens for the hospital. The laboratory is well equipped with both instrumentation and qualified staff, and most of the modern instrumentation has been provided through private donations. Unfortunately, the number

of specimens the laboratory actually processes is relatively small and the laboratory essentially serves only the needs of the hospital. The laboratory does have a modern laboratory information system that is currently being used to process specimens and report results electronically. Management reports compiled and sent to the Ministry of Health, however, are still produced manually.

The representatives of the National Hospital who were present at our discussion meeting strongly expressed a desire to expand this type of system to other hospital laboratories in the country as well as provide a mechanism for electronic reporting to the Ministry.

On Thursday, the APHL team presented its draft action plan to Tanzania's Chief Medical Officer and CDC's Chief of Station. That plan recommended the phased-in installation of laboratory information systems in some of the country's laboratories and made specific recommendations to simplify and improve the current reporting structure. In addition, the plan incorporated a tentative implementation timeline for these installations and outlined the responsibilities the country and APHL needed to undertake as a part of this implementation. Because the draft plan was presented orally as a PowerPoint presentation, the final written plan will be presented to the Tanzanian Ministry of Health sometime in April.



The Muhimbili National Hospital laboratory has acquired current technology and is slowly growing its sampling capacity.

I currently co-chair APHL's Informatics Committee along with Steve Hinrichs, the Director of the Nebraska Public Health Laboratory. The committee has been responsible for the association's involvement in both the production of LIMS documents and the development of strategic planning for the future of IT projects in public health laboratories. I will assume the full chairmanship of the committee in July when Steve Hinrichs relinquishes his role.

This committee has also been instrumental in the promotion of several LIMS collaborative projects that have led to LIMS implementations in several state laboratories around the country. One of those, the Vocabulary Harmonization Project, is being conducted in conjunction with CDC and will eventually provide a standardized list of LOINC and SNOMED codes, which can be used by all public health laboratories to electronically communicate laboratory results between individual laboratories and between public health laboratories and CDC. Currently, while there is a defined standardized data format in place for electronically moving data from one place to another, the codes used in that format for relaying laboratory results vary from laboratory to laboratory. So while laboratories may be able to send result data to another laboratory, it is possible that the receiving laboratory will not be able to interpret those results. This project, when it is complete in late summer, will solve that problem.

I also continue to work with several state public health laboratories that are continuing APHL's previous work by collaboratively developing an actual physical LIMS system based on the Requirements and Design documents. This project is also supported by APHL's Informatics Committee. That system has the capacity to be used in local, state and federal laboratories, is database and operating system independent and highly scalable. It represents what we believe is the future of LIMS in the public health laboratory largely because it was designed specifically for public health laboratories and their unique requirements. We do believe that such a system may also be applicable to developing countries because of its capacity to manage and transfer public health data at a relatively nominal cost for implementation and maintenance.

I want to thank the Association of Public Health Laboratories for asking me to participate in this project and making the funding available for this trip. I'd also like to thank the Centers for Disease Control who provided much of the logistical support while we were in Tanzania. Finally, I want to thank KDHE Secretary Roderick Bremby and Dr. Duane Boline, KDHE Laboratories Director, for allowing me to participate in this project and for their ongoing support of projects such as this one which provide opportunities to build the global infrastructure necessary to effectively combat disease throughout the world.